Appl. No. 10/708,242
Amdt. dated July 27, 2006
Reply to Office action of March 27, 2006

REMARKS

Claims 1-11 and 78-81 are rejected under 35 USC 103a as being unpatentable over applicant's admitted prior art in view of US Patent 6,961,813 granted to Grieff et al.

5   Applicant asserts that claims 1-11 and 78-81 should not be found unpatentable over applicant's admitted prior art in view of Grieff et al. because neither Grieff et al. nor the applicant's admitted prior art teach all the elements as recited in claims 1-11 and 78-81, and additionally because there is no motivation to combine the teachings of Grieff et al. with the applicant's admitted prior art.

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In the Office Action (mailed 03/27/2006), the Examiner deemed that "Claims 1-11 and 78-81 are rejected under 35 USC, article 103(a) as being unpatentable over applicant's admitted prior art in view of US patent 6,961,813 granted to Grieff et al.," Applicant, however, respectfully does not agree with the Examiner's opinion.

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Concerning claim 1, the Examiner deemed that "As per claim 1, applicant's admitted prior art teaches, "a host entity" in fig. 2; "a storage virtualization controller (SVC)" in Fig. 2, elements SVC1 & SVC2; "a set of physical storage devices (PSD)" in Fig. 2. Applicant's admitted prior art fails to expressly teach the "redundancy of the storage
20   controllers" and "point-to-point serial signal interconnect". However, the above features were well known to one of ordinary skill in the data processing art at the time the invention was made as evidenced by Grieff et at. The reference of Grieff et at. teaches the features in col. 15, lines 10-22. ... "The reference of Grieff et al. teaches the motivation in col. 1, lines 23-27.""

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US patent 6,961,813 ('813 patent) by Grieff et al., recites in col. 15, lines 10-22 the following: "The present invention may be implemented in a storage device for use in

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a storage network. The storage device may be a storage disk array for use in an enterprise storage system (i.e., a SAN), or a storage server useful for network attached storage (i.e., NAS) comprising one or more storage cells, wherein each storage cell may comprise a pool of storage devices. Each storage cell may comprise redundant storage controllers
5   coupled to the disk group. The storage controllers may be coupled to the storage devices using a suitable high-speed data connection, or through a network such as a FC fabric or the like. The storage controllers may be communicatively coupled through a point-to-point connection such as, for example, a PCI bus or a SCSI bus."

10   According the recitation in col. 15, lines 10-22, "Each storage cell may comprise redundant storage controllers coupled to the disk group. The storage controllers may be coupled to the storage devices using a suitable high-speed data connection, or through a network such as a FC fabric or the like." Therefore, "redundant storage controllers" is mentioned therein and "the redundant storage controllers are coupled to the disk group" is
15   also mentioned therein. In addition, "The storage controllers may be coupled to the storage devices using a suitable high-speed data connection" is also mentioned, but no specific type of connection is pointed out. Moreover, a specific network type "FC fabric" is mentioned to point out for the connection between the storage controllers and the storage devices.
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A typical device-side implementation of this would be one in which device-side IO device interconnects are of the multiple-initiator, multiple-device kind (such as Fibre, Parallel SCSI), and all device-side IO device interconnects are connected to both SVCs such that either SVC can access any PSD connected on a device-side IO device
25   interconnect. When both SVCs are on-line and operational, each PSD would be managed by one or the other SVC, typically determined by user setting or configuration.

According the recitation in col. 15, lines 10-22 "The storage controllers may be

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communicatively coupled through a point-to-point connection such as, for example, a PCI
bus or a SCSI bus." Therefore, two things are pointed out. First, the connection between
the redundant storage controllers is mentioned here. Second, the possible connection such
as "a PCI bus or a SCSI bus" between the redundant storage controllers are mentioned
5   and the connection is called "a point-to-point connection". From the first we know that,
no connection between a storage device and redundant storage controllers is mentioned;
the connection mentioned here is for the communication between the redundant storage
controllers. In the present invention, this connection is referred to as "inter-controller
communications channel (abbreviated ICC)". For the second, it is known to persons of
10 ordinary skill in the art that (1) PCI bus and SCSI bus are parallel buses, and that (2) PCI
bus and SCSI bus are buses of the multiple-initiator, multiple-device kind, i.e.,
multiple-device IO device buses, in which the SCSI bus is particularly raised as a prior art
example in the specification of the present invention.

15   For a parallel bus, many transmission lines, such as data signal lines and control
signal lines, should be provided in the bus for signal/power transmission. For a PCI bus,
there are over 100 transmission lines (124 pins for 32-bit bus, 188 pins for 64-bit bus),
while for a SCSI bus, there are 68 transmission lines in a flat cable thereof.

20   For a multiple-device IO device bus (multiple-device IO device interconnect),
multiple devices can be connected on the bus. For example, for a PCI bus used in a south
bridge chip of a CPU chipset, lots of I/O devices can be attached thereto, while for a SCSI
bus used in a computer for attaching SCSI hard disk drives (HDDs), we may attach 7
HDDs thereto. Therefore, PCI bus and SCSI bus are multiple-device IO device buses and
25 will function like a multiple-device IO device bus in essence and not function in a
point-to-point way. For a PCI bus or a SCSI bus used as an ICC, since it is a
communication connection between two storage controllers, there are only two devices
connected at the ends of the ICC, i.e., the storage controllers, with each controller

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connected at each end of the ICC. When one device (for example, a first controller therein) acts as a master or an initiator, there will be only one other device (for example, a second controller therein) attached to the bus as a slave or a target; and therefore it looks like the two devices communicate in a point-to-point way although actually it is not in essence.

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As explained above, "PSD coupled to the redundant storage virtualization controller pair through a point-to-point serial signal interconnect" is not disclosed in the recited paragraph.

10   The '813 patent recites in col. 1, lines 23-35 the following: "The increased importance of information technology in business processes has fostered increased demands for data storage systems that combine the features of high storage capacity, high reliability, efficient scalabilty, and cost-effectiveness. Early computer systems relied heavily on direct-attached storage (DAS) systems consisting of one or more disk drives

15   coupled to a system bus. DAS systems were not well adapted to satisfy these demands. More recently, storage area network (SAN) technologies have been implemented. SAN architectures permit organizations to uncouple application servers from data servers to provide storage systems with greater capacity, higher reliability, and higher availability."

20   Therefore, we can understand that the recitation in col. 15, lines 10-22 that "The increased importance of information technology in business processes has fostered increased demands for data storage systems that combine the features of high storage capacity, high reliability, efficient scalabilty, and cost-effectiveness" wants to tell us that "storage area network (SAN)" is a technology meeting the demands of high storage

25   capacity, high reliability, and efficient scalabilty rather than the direct-attached storage (DAS) system. No motivation to provide "redundancy of the storage controllers" or "point-to-point serial signal interconnect" is taught. Nor is motivation to provide "PSD coupled to the redundant storage virtualization controller pair through a point-to-point

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serial signal interconnect" shown.

In the specification of the present invention, however, the motivation to invent the present invention as claimed in claim 1, especially for the element "a set of at least one
5   physical storage device for providing storage to the computer system, with at least one member of said set of at least one physical storage device comprising a PSD coupled to the said redundant storage virtualization controller pair through a point-to-point serial signal interconnect;" is shown. Please refer to paragraph [0019] and [0020] below.

10   "[0019] ...The configuration shown in Fig.1 suffers from the drawback that a malfunction of a single PSD, depending on the nature of the malfunction, can potentially bring down an entire device-side IO device interconnect making all other PSDs connected on the same interconnect inaccessible.

        ...

15   [0021] While the configuration depicted in Fig.2 is, indeed, far more robust than that depicted in Fig.1 in the face of device-side IO device interconnect failure, there is still the possibility that a PSD might malfunction in such a way that it could bring down both IO device interconnects that are connected to its dual-ported port pair. Were this to happen, once again, access to other PSDs connected on the same interconnect pair would be
20   disrupted. In a logical media unit that consists of a standard singly-redundant RAID combination of PSDs (e.g., RAID 5), this could prove disastrous for it can cause multiple PSDs in the combination to go off line causing the entire LMU to go off line."

        Therefore, Applicant clearly pointed out the shortage of the prior arts shown in Figs.
25   1 and 2.

        Because the '813 patent neither disclosed all elements of claim 1, nor taught the motivation to combine recited technology with existing technologies into the claimed

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invention as in claim 1, Applicant respectfully asserts that claim 1 should be found patentably distinct from the prior art in the '813 patent and the admitted prior arts in the specification, and should therefore be found to be in a position of allowance with respect to said cited arts.

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As to dependent claims 2-3, for at least the same reasons, the motivation to combine recited technology with existing technologies cannot be found. In addition, since claim 1 is believed by applicant to now be in position of allowance, claims 2-3 dependent on claim 1 should also now be found in position of allowance.

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As to dependent claims 4-6, the Examiner deemed that applicant's admitted prior art teaches the added limitations of the claim in Fig. 2 and Paragraph [0018] of the specification of the invention. However, Paragraph [0018] of the specification of the invention only pointed out that "Traditional storage virtualization has been done with

15 parallel SCSI or Fibre IO device interconnects as the primary device-side IO device interconnects connecting physical storage devices to the storage virtualization controller pair. Both Parallel SCSI and Fibre are multiple-device IO device interconnects. A multiple-device IO device interconnect is a form of IO device interconnect that allows multiple IO devices to be connected directly, meaning without the need for any extra

20 off-device intervening active circuitry, to a single host system or multiple host systems (note that typical FC-AL JBODs do have off-device active circuitry, but the purpose of this circuitry is not to enable the interconnection but rather to accommodate the possibility of a failure in the DASD or a swapping out of the DASD that might cause a fatal break in the IO interconnect). Common examples of multiple-device IO device

25 interconnects are Fibre channel FC-AL and Parallel SCSI. Multiple-device IO device interconnects share bandwidth among all hosts and all devices interconnected by the interconnects." Therefore, the element cited in claim 4: "at least one device-side IO device interconnect port provided in a said at least one IO device interconnect controller

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coupled to said at least one physical storage device through a point-to-point serial-signal interconnect" is not shown. Nor is the motivation to combine shown.

5   In addition, the element cited in claim 6: "a said host-side IO device interconnect port and a said device-side IO device interconnect port are provided in different said IO device interconnect controllers" is not shown in the prior art. Furthermore, the above element in claim 6 is not straightforward for a person of ordinary skill in the art and no motivation is therefore shown.

10   According to the above dependent claims 4-6, in addition to the fact that claim 1 is believed to be in a position of allowance, applicant respectfully asserts that claims 4-6 dependent on claim 1 should also be found to be in position of allowance.

Because the Examiner rejected claim 7 using the same reasons for rejection of claim
15   1, applicant respectfully deems that, for the same reasons discussed above for supporting the patentability of claim 1, that the element of claim 7: "a PSD coupled to the said redundant storage virtualization controller pair through a point-to-point serial signal interconnect" is not shown and the motivation for combination is not taught.

20   Since claim 7 is believed to be in position of allowance, applicant respectfully asserts that claims 8-11 dependent on claim 7 should also be found to be in a position of allowance.

Because the Examiner rejected claim 78 using the same reasons as for the rejection
25   of claim 1, applicant respectfully asserts that, for the same reasons discussed above for supporting the patentability of claim 1, that the elements of claim 78:
       "at least one IO device interconnect controller coupled to said central processing circuitry;

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at least one host-side IO device interconnect port provided in a said at least one IO device interconnect controller for coupling to said host entity; and

at least one device-side IO device interconnect port provided in a said at least one IO device interconnect controller for performing point-to-point serial signal transmission
5   with at least one physical storage devices;"

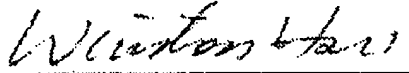are not shown and the motivation for combination is not taught.

Because claim 78 is believed to be in a position of allowance and further because the element cited in claim 80: "a said host-side IO device interconnect port and a said
10   device-side IO device interconnect port are provided in different said IO device interconnect controllers" is not shown in the prior art, and further because the above element in claim 80 is not straightforward for a person of ordinary skill in the art and no motivation is therefore shown, claims 79-81 dependent on claim 78 are also believed to be in a position of allowance.

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In conclusion, applicant asserts that claims 1-11 and 78-81 should not be found unpatentable over applicant's admitted prior art in view of Grieff et al. because neither Grieff et al. nor the applicant's admitted prior art teach all the elements as recited in claims 1-11 and 78-81, and because there is no motivation to combine the teachings of
20   Grieff et al. with the applicant's admitted prior art. Because claims 1-11 and 78-81 are believed to be in a position of allowance, objected dependent claims 12-77 and 82-108 should also be found allowable with respect to the cited references. Reconsideration of claims 1-11 and 78-81 is respectfully requested.

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Sincerely yours,

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10   Note: Please leave a message in my voice mail if you need to talk to me. (The time in D.C.
is 12 hours behind the Taiwan time, i.e. 9 AM in D.C. = 9 PM in Taiwan.)

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